LOUISIANA TECHNOLOGY INNOVATIONS FUND PROGRESS REPORT
1 September, 2001
for the period ending 30 June, 2001

I. DEPARTMENT / AGENCY

Louisiana State University, Department of Physics and Astronomy

II. PROJECT TITLE

"Training Today's Students for Tomorrow's Internet Work Environment"

III. PROJECT LEADER

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IV. DESCRIPTION OF THE PROJECT

During this project we will develop a system to provide today's school children with experience in using the internet to control, access and operate robotic instruments much in the way that they may in tomorrow's high technology network based work environment. This will include internet control interfaces for the Highland Road Park Observatory telescope, for the ATIC balloon-borne "space" experiment and for a HAM radio satellite communication system. In addition a group of teacher leaders will work with us to develop a curriculum that will provide the context and structure necessary for students to use these internet accessed instruments effectively. During the project we will partner with various community and business organizations such as HAM radio operators, amateur astronomers, Southern University, LaSPACE, and a local television station to provide needed expertise and to enhance the quality of the product. The final products of this project will include a set of operational internet "robots", the materials necessary to train teachers in the use of these devices, the supporting classroom materials to be used by students, and an evaluation of the project effectiveness based upon classroom assessments

V. PROJECT STATUS

A. Brief Summary

During the period December 2000 through June 2001 we were able to make significant progress on the project. The main project web site was completed and provides a general guide to the project “robots” and lessons. The ATIC “robot” is essentially complete and we did phase 2 refinements on the classroom lessons. The radio hardware is on-site and partially installed; an initial version of the radio web site was completed along with the radio internet interface and a collection of classroom lessons. We also made progress in completing the internet direct user

interface for the telescope and in finalizing details of the auxiliary telescope to be placed at LIGO. Finally, we began planning a workshop for the end of July where a group of teachers will be trained in the use of internet instruments and classroom lessons. This group will be followed over the academic year as they present the lessons to their students and evaluation information will be collected.

B. Accomplishments

On January 13,2001 the ATIC long duration balloon experiment terminated its 16 day mission to the very edge of space above the continent of Antarctica. Through this LTIF project we were able to provide, during the pre-flight setup, flight operations and subsequent payload recovery, near real time coverage from Antarctica of the events and activities of the ATIC program. Further, flight housekeeping data (e.g. pressure, temperatures, altitude, latitude, longitude) was provided for each flight day as it was downlinked from the ATIC experiment via satellite telemetry. These data were then used in classrooms to provide real world experience with experiment data and its analysis. For example, Greg Sollie at Catholic High School led his 5 physics classes in a four day long laboratory in downloading the ATIC data, plotting the daily variations in temperature, pressure and altitude, and developing an explanation for these variations. From Mr. Sollie and other teachers who used the ATIC site in their classrooms we identified a few problems that we addressed. In particular, the teachers were overwhelmed with the massive amount of housekeeping data ATIC produced during its flight and did not know how to proceed. Consequently, the Teacher Leader group developed additional lessons to be included with ATIC that focus on data analysis fundamentals. Specifically, these lessons provide teachers and students with training in how to sample the data, how to select data, how to plot data and, in general, to make correct judgments in how to extract information from a large dataset with the minimum of effort. These concepts and techniques are fundamental to scientific work, but have wide application to areas such as business modeling / evaluation and engineering.

With the ATIC component of ROBIE well developed, attention turned to the HAM radio station. All equipment associated with the radio system was ordered and prepared for installation at the Highland Road Park Observatory (HRPO) during this period. A preliminary web site was established and issues involving internet control of the radio equipment were resolved. The web site includes information on the radio status, pictures of the antenna tower install at the observatory, details on the radio hardware and our preliminary internet interface for the radio. The interface implemented allows the radio to be tuned to a particular frequency, for the antenna to be pointed in a particular direction and for audio to be transmitted and received. We also performed an end-to-end test of the internet interface. A user was able to access the web page from his office computer, control the HAM radio set and use the system to talk with another operator elsewhere on campus via radio link. We have also been able to use the radio to listen to beacons from HAM radio satellites as they pass over Baton Rouge. Much of this development work took place on the LSU campus and during early summer 2001 the radio equipment and control computer will be moved to the observatory to complete the installation. In conjunction with the hardware / software effort, the Teacher Leader group developed several lesson plans including “The Importance of Satellites”, “Viewing / Tracking Satellites”, “Understanding Orbits”, “Palm Pipes and Pitch”, and “Frequency and Wavelength”. These lessons are centered on the technology of satellites and how these devices are used in modern

communication. These lessons and others developed by the Teacher Leader group are available through the radio web site. Over the summer we will finalize the radio web site, classroom lessons and hardware install.

Major progress on the optical telescope internet control software was also achieved over the last period. Supported by the LSU Department of Physics and Astronomy, a programmer was dedicated to implementing this software. Currently, the software provides direct control of the telescope pointing, dome motion, dome shutter open / close, telescope focus and CCD camera. To simplify telescope handling for the teachers we have incorporated the Starry Night Pro (SNP) commercial software package. SNP provides an easy to use display of stars, planets, galaxies and other interesting astronomical object on the users computer screen as they would appear in the sky. Our software interfaces to SNP and allows the remote user to point the telescope merely by clicking on an object using the mouse. From the SNP program the dome, focus and camera control windows can be displayed by selecting from a menu. We also began informally working with a group of software experts from the US and Canada who are dedicated to establishing a set of standards for astronomical instrument interfacing referred to as ASCOM. Once we implement the ASCOM standard into our software we will be able to take advantage of a wide range of astronomical software tools that can greatly expand the capability of our interface.

We have been working with LIGO to establish an auxiliary telescope on their site and are proceeding with bids for the telescope as proposed. There are still several issues with the LIGO site that must be addressed. First, LIGO wants this telescope to be a centerpiece for a major new educational center for which they are attempting to obtain construction funding. I am attempting to obtain a schedule from LIGO as to when this building will be ready; if there are delays in the LIGO education center building, we may not be able install the auxiliary telescope until next year. Second, the telescope site proposed by LIGO would place the prime field of view of the telescope directly over the main LIGO building roof. Heating of the roof during the day and cooling during the night will likely cause thermal waves in the atmosphere through which the telescope must look, resulting in a degradation in the telescope performance. I have, therefore, requested that LIGO look for an alternate location for the telescope on its site. We are currently working with the LIGO Livingston Director to address these issues and to establish a MOU on areas of responsibility as well as operation and usage procedures.

Finally, cost savings on the project due to advances in technology, reduced hardware costs and efficiency in our implementation may be sufficient to allow us to extend the capability provided by this LTIF project. In particular, we may be able to purchase additional remote controlled telescope systems using a Meade 12” LX200 telescope. I have contacted the Louisiana School for Math, Science and the Arts (LSMSA) in Natchitoches, LA and they appear to be interested. We may also be able to purchase a simple and inexpensive Radio Telescope which could be added to the project as a fourth “robot” and provide classrooms with a method to observe the Sun, the galactic disk and other sources in radio waves during the day time. During this summer I will be preparing a rebudgeting request and submit it to LTIF for your approval.

C. Problems Encountered

No major problems have arisen during the reporting period that could not be addressed and we do appear to be back on schedule. Some issues on the details of the telescope CCD camera control but these are being worked. Further, over the reporting period two commercial software vendors have released packages that would allow us to control the HRPO and LIGO telescopes over the internet. We have purchased both of these packages and are in the process of evaluating them. Thus, in the unlikely event that our software development fails to produce the desired result, we have two backup options in hand.